

<p align="center">LLNL Environmental Restoration Division Standard Operating Procedure</p>	<p align="center">TITLE: Pressure Transducer Calibration</p>
<p>APPROVAL _____ Date _____</p> <p>Environmental Chemistry and Biology Group Leader</p>	<p align="center">PREPARERS: J. Chiu*, R. Ferry*, J. Martin*, J. Mcdonald*, and E. Nichols*</p> <p align="center">REVIEWERS: T. Carlsen and V. Dibley</p>
<p>APPROVAL _____ Date _____</p> <p>Division Leader</p> <p>CONCURRENCE _____ Date _____</p> <p>QA Implementation Coordinator</p>	<p align="center">PROCEDURE NUMBER: ERD SOP-3.2</p> <p align="center">REVISION: 2</p> <p align="center">EFFECTIVE DATE: December 1, 1995</p> <p align="center">Page 1 of 4</p>

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1.0 PURPOSE

To ensure accurate and consistent water-level measurements using pressure transducers.

2.0 APPLICABILITY

This procedure is applicable to field personnel who perform pressure transducer calibrations.

3.0 REFERENCES

- 3.1 *In Situ*, Inc. (1984), Owner's Manual: Hydrologic Analysis System, Model SE200.
- 3.2 Enviro-Labs, Inc., Operator's Manual, Data Logger DL-120-MCP.

4.0 DEFINITIONS

4.1 Pressure Transducers

Pressure transducers are devices to measure hydrostatic pressure, which can be converted to ground water elevations. A transducer is designed to measure pressures over a specific range of submergence. Outside this range, measurements will not be accurate, and the transducer can be damaged if submerged to depths exceeding the design range or subjected to negative pressures.

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5.0 RESPONSIBILITIES

5.1 Division Leader

The Division Leader's responsibility is to ensure that all activities performed by ERD at the Livermore Site and Site 300 are performed safely and comply with all pertinent regulations and procedures, and provide the necessary equipment and resources to accomplish the tasks described in this procedure.

5.2 Field Personnel

Field personnel are responsible for the proper calibration and documentation of the pressure transducers according to this procedure.

6.0 PROCEDURES

6.1 Office Preparation

- 6.1.1 Coordinate schedules/actions with task leader or study area leader, as appropriate.
- 6.1.2 Review the operator's manual provided with the electronic data logger, if appropriate.
- 6.1.3 Check to be sure the electronic data logger is fully charged and that the logger and pressure transducer are operating properly. Test the electronic data logger and transducer using a container of water (e.g., sink or bucket of water). Always bring additional transducers in case of malfunctions.
- 6.1.4 Enter record of calibration into the Hydraulic Testing Logbook.
- 6.1.5 Review appropriate sections of the Site Safety Plan.

6.2 Field Preparation

- 6.2.1 Locate the monitor wells where the pressure transducers will be calibrated and identify the appropriate decontamination areas.
- 6.2.2 Assemble appropriate testing equipment.
- 6.2.3 Decontaminate the transducer and cable as specified in SOP 4.5, "General Equipment Decontamination."
- 6.2.4 Measure the initial water level for the calibration monitor well and record on the Hydraulic Test Data Sheet (see SOP 3.3, Attachment B).
- 6.2.5 Before beginning the calibration, record and enter information into the electronic data logger. The type of information may vary depending on the model used. Consult the operator's manual for the proper data entry sequence to be used. For example, the following data is entered into the Enviro-Labs Model DL-120-MCP Data Logger:
 - 1. Baud rate.
 - 2. Station ID.
 - 3. Date (YY/MM/DD).
 - 4. Time (HH:MM:SS).

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5. Scale factors for each channel.

6.3 Operation

Several precautions should be taken when using submersible pressure transducers. Silicon diaphragm transducers are fragile and should always be handled carefully to minimize shock. The transducer cable is vented so that temperature and barometric pressure will not cause variations in the transducer reading. If the vent port is plugged, inaccurate readings will result. If water enters the vent and flows downward into the transducer, the transducer may be damaged. The transducer cable is susceptible to both physical damage (e.g., abrasion on sharp well casings) and chemical degradation from solvents. Damaged cable can cause damage to transducers during submergence, and inaccurate readings may result.

- 6.3.1 Cover sharp edges of the well casing with duct tape to protect the transducer cables.
- 6.3.2 Connect the transducer cable to the recording device (e.g., Enviro-Labs Data Logger, *In Situ* Hermit, Campbell Micrologger 21X).
- 6.3.3 Slowly lower the transducer and cable down the well to a depth below the target drawdown estimated for the test but at least 1 ft from the bottom of the well. Be sure this depth of submergence is within the design range stamped on the transducer. Mark this depth on the cable using a piece of duct tape. A temporary standpipe may be filled and used for transducer calibration if wellhead access is not available.
- 6.3.4 Partially withdraw the transducer and cable, and accurately measure a distance greater than 3 ft. Mark this depth on the cable using a piece of duct tape. Temporarily tape the transducer cable to a stationary object to keep the transducer at a constant depth.
- 6.3.5 Display the current water level on the recording device according to the manufacturer's instructions. Record the current water level on the Hydraulic Test Data Sheet.
- 6.3.6 Lower the transducer the distance measured in step 6.3.4. Record the new water level displayed on the recording device.
- 6.3.7 Calculate a transducer scale factor correction (SFC) as follows:

$SFC = (L/W)$, where

L= distance that the transducer is lowered during calibration, measured in step 6.3.3, and

W= difference between the two water level measurements on the recording device.

- 6.3.8 Record the transducer scale factor correction on the Hydraulic Test Data Sheet. If the scale factor correction is considerably more than 0.01, then repeat steps 6.3.5 through 6.3.7. If the recalculated scale factor corrections are not similar to each other after three attempts, replace the transducer. Multiply all changes in water level measured by the calibrated transducer by the scale factor correction to obtain actual water level changes.

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- 6.3.9 If transducers are installed for a period exceeding one day, periodically take water level measurements by hand to verify the function and accuracy of each pressure transducer. Transducers installed for one week should be verified daily; installations left for longer periods can be hand-verified less frequently, depending on the required accuracy of the data.

6.4 Post Field Operation

- 6.4.1 Continue the water-level measurement task (e.g., slug test or pumping test).
- 6.4.2 Decontaminate the transducer and cable per SOP 4.5 at the completion of the task. Do not use solvents to decontaminate the transducer cable.
- 6.4.3 Complete shutdown of the electronic data logger:
1. Stop the logging sequence.
 2. Save memory and disconnect the battery at the end of the testing activities.
- 6.4.4 Replace testing equipment in storage containers.

6.5 Office Post Operation

- 6.5.1 Complete Hydraulic Test Data Sheet and Hydraulic Test Logbook entries. Deliver copies of documentation to the Data Management Group, hydrogeology group leader, and study area leader/task leader, as appropriate.
- 6.5.2 Arrange for the repair of any transducers that were damaged or could not be calibrated.

7.0 QA RECORDS

- 7.1 Test Data Sheet
- 7.2 Logbooks

8.0 ATTACHMENTS

Not applicable.